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**GB 2276639 A EP 0467855 A2 WO 90/13699 A1  
WO 88/00482 A1 US 5023019 A US 4737406 A  
US 3974318 A US 3935343 A**

(58) Field of Search

**UK CL (Edition O ) D1P PDH PDX PH PWE PWH  
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11/79**

(54) **Flame retardant compositions**

(57) Aqueous and or sodium silicate compositions which can be non-toxic, bio-degradable, non hazardous, edible and non-ozone depleting and environmentally acceptable to provide fire extinguishing and/or fire inhibiting and/or insulating and/or water resistant and/or adhesive properties either on site and particular in the production line to all forms of cellulose content materials in particular paper, cardboard, wood, thatch, bush, brush, straw and forestry and christmas trees and similar flammable substrates.

A variation of the formulation adheres to steel, metal, wood, plastic, cardboard etc. to provide insulation against heat and cold and also provides the ability to render them unable to support combustion.

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PROTEA

INSULATING/FLAME INHIBITING & FIRE EXTINGUISHING  
AND ADHESIVE COMPOSITIONS

5. This invention relates to flame inhibiting, flame inhibiting and insulating, flame inhibiting and waterproofing, flame inhibiting and adhering compositions particularly, but not exclusively for the treatment of celulostic based content
10. materials such as cardboard, paper, pulp, wood, wood products, plywood, and combinations thereof, not only by application in the mill and production line but also 'in situ'.
15. Variations of the formulation can offer the facility of fire retarding bush, brush and forestry including thatch and animal fodder without damage to fauna and flora and harmless when consumed by animals.
20. This particular varied formula acts as a most effective fire extinguisher for use in fighting forest and bush fires and simultaneously providing fire breaks.
25. A further variation renders the mixture water resistant and able to withstand rainfall while still retaining its fire retardent properties. When used to treat Xmas trees the life of the tree is extended and prevents the needles from dropping off.

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5. For some time it has been recognised that the flammability of products represents a hazard, in their many uses, including in construction and building work, and in industrial, farming, forestry, commercial and domestic applications and
10. where there is the possibility that they may not only be exposed to flame but also to temperatures sufficiently high to cause spontaneous combustion not only to the fuel itself, but also to cause it to transmit heat and fire to nearby
15. flammable materials. In the case of packaging to the contents of the package. case of

- The thermocouples as used in the steel mills, are encased in a cardboard tube. When these tubes and the adhesive are protected with this patent it provides
20. additional insulating protection and also extends the time available to allow the thermometer to obtain a more accurate reading.

5. In regard to flame retarded products, there is renewed concern regarding the burning behaviour and smoke density and gas component under the influence of radiating heat and flames and determination of the gas component in the smoke. Forest, brush, and bush fires are of most serious concern and result in large loss of life and damage to property, fauna and flora worldwide.. The formulae herein listed can satisfactorily deal with these problems.
- 10.
15. Serious, costly and even fatal consequences have resulted from the ignition and the transfer of high temperatures and flame, and more specifically to the content of packages containing temperature sensitive contents and also in construction, and in industrial and production situations where control of temperature is a vital factor.
5. Insulating products in construction, refrigeration and air conditioning and cooling equipment and systems, engines used in aircraft and other vehicles frequently use products which are now considered to be environmental hazards and to contribute to ozone depletion.

5. The paper and cardboard packaging and tissues, napkins and table-cloths in contact with food requiring to be flameproofed, and particularly when used in aircraft, ships, trains, and other forms of public transport should be fireproofed with an edibly safe and harmless fire retardant.

10. Whilst number of fire retardents are available for the treatment of cellulosic products, fabrics, synthetic content, including cot mattresses and porous products with the ability to fire retard or slow the burning process or result in self extinguishing of the flammable substrate but without either the ability to provide a control of the amount of insulation, or without having due regard of the toxic or environmental hazards.

20. There are a number of situations which require high degrees of insulation with lesser degrees of fire and flame inhibition.

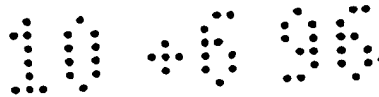
25. For example: Electronic thermometers encased in metal tubes and protected in a tube of cardboard are in constant use to measure the temperature of steel in production in the steel mills. Within fractions of a second the intense heat destroys the cardboard and frequently damages and destroys the delicate electronic thermometer.

5. Additional insulation grants the technicians a longer exposure time of the thermocouples to the high temperature radiation and contributes to a reduction in the number of expensive thermometers being destroyed and allows for more accurate temperature readings.
- 10.

- In many cases military uniforms, military tents, work clothing do not only require to be fire retarded but also to offer a degree of insulation.
15. Variations of the formula and application of the product allow this invention to provide a method not only of flame retarding and inhibiting but also to provide a greater degree of insulation with or without a lesser degree of fire and flame inhibiting. such as the circumstances may require.
- 20.

Further variations of the formula can provide fire retardent protection without harm to the environment and/or are edibly safe and may be rain and water resistant.

25. According to the invention there is provided a controllable degree of insulating and/or flame retarding and inhibiting composition for cellulose content materials including in particular cardboard produced from paper and waste paper pulp etc., the composition comprising being an aqueous solution
30. consisting in varying degrees including and/or

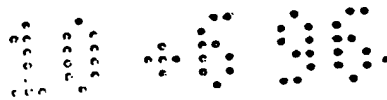


5. excluding some of the recommended ingredients listed below. The required compositions can consist of varying mixtures and percentages of parts of the following:-
10. a) Kalium.  
b) Citric acid  
c) Monammonium Phosphate  
d) Di-ammonium Phosphate  
e) Ammonium Sulphamate
15. f) Urea  
g) Ammonium Sulphate  
h) Sodium silicate  
i) Calcinated china clay  
j) Volcanic glass rock containing:
20. Silica (as % Si O<sub>2</sub>- 76.0% ); Titanium ( as % Ti O<sub>2</sub>- 0.5%); Aluminium (as % Al<sub>2</sub> O<sub>3</sub>- 14.0%); Iron (as % Fe<sub>2</sub> O<sub>3</sub>- 1.5%); Manganese (as % Mn O<sub>2</sub>- 0.7% ) Calcium (as % CaO- 2.0%); Manganese (as % MgO-0.8%); Sodium as % Na<sub>2</sub> O- 5.0%); Potassium (as % K<sub>2</sub> O- 4.0%); (less loss on ignition 3%)
15. k) Atmospheres ( Hollow Glass Micro balloons) containing: Silica (as SiO<sub>2</sub> 55-60%, Alumina (as Al<sub>2</sub> O<sub>3</sub> 25-30%) Iron Oxides (as Fe<sub>2</sub> O<sub>3</sub> 4-10%), Calcium as CaO 0.2-6% Magnesium (as MgO 1-2%) Alkalis (as Na<sub>2</sub> O, K<sub>2</sub> O 0.5- 4%)
- 20.
25. l) A corrosion inhibitor where corrosion prone metallic items may require protection from contact.

- 11 4 5 5
5. m) An identifying fragrance to distinguish between treated and untreated substrates or to identify the contents of the package where the markings on the package may have been destroyed by carbonisation in the flame.
10. n) Sulphuric acid  
o) A Glycerin/acetic Acid X-linking agent to adjust the setting time of the mixture.  
p) Cardboard dust or sawdust.  
q) A fluorescent responsive chemical to enable the identification of the treated areas with a fluorescent lamp.
15. r) Surfactant  
s) Tripotassium citrate  
t) Zinc oxide  
u). Anti-foaming agent
20. v) Gelatine  
w) Filtered water.

The application of the products can be by dipping, fogging, brushing, spraying, padding or by rolling and drying at ambient temperature. In the paper and cardboard mill by application in the size press and/or calendar stack or by spraying.





5. The mixtures are water and/or sodium silicate based depending on the end use and the local environment considerations and can by variation be adjusted to be either:

non hazardous, non-toxic, edible, bio-degradable, non ozone depleting, environmentally acceptable and in conformance with the applicable standard and it can be applied either in the production of the substrate to be protected or in situ without the need for other than normal industrial protective precautions, including gloves, a simple mask and goggles.

An add-on dry weights of from 2% to 16% have been shown to give satisfactory fire retarding results depending on the chemical combination and the end result required.

20. E X A M P L E S

(A) A composition was formulated consisting of (from the chemicals above listed):

c), d), G), l), n), q), r), s), u), w).

and was tested on paper, tissue paper and on cardboard of various thicknesses, it was found that when dry, after a light spray on to a 2 ply tissue, the tissue was exposed to the flame from a butane portable blow torch and the tissue carbonised without flaming and that without any discomfort a hand could be placed less than one inch from the back of the tissue whilst the front was glowing red

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- from the flame and heat of the blow torch.
- \* A flammable plastic computer disc was placed into cardboard box which had been immersed in a the formula and dried. The box was soaked with
10. high octane spirit and set alight. After the spirit was no longer burning a blow torch was applied to the outside of the box until it glowed red.
15. The box carbonised where the torch flame had been applied, and the box neither flamed or smouldered. The box was opened and the computer disc removed and placed into the computer where it operated normally.
20. (B) A composition was formulated consisting of  
d), g), . k), o),  
The composition was sprayed on to a 2 ply cardboard at the rate of 2% w/w on each side. When dry the cardboard was rolled into a tube consisting of under 10 winds and glued with a mixture consisting of  
"B" above and h), i), k), q),  
The tube was allowed to dry and set and the flame from a butane blow lamp was applied to the exterior of the tube whilst a thermometer had been
30. inserted into the tube.

5. After 10 seconds and 20 seconds no increase in temperature within the tube was recorded on the thermometer. After 30 second the temperature increase within the tube was under 4 degrees C.
10. (C) A tube prepared as per "B" above was coated with under 2 millimetres of a mixture consisting of h), i), k), q),  
A thermometer was inserted and a blow torch applied as per "B" above and after 1 minute no  
15. increase in temperature was recorded.

- In all the tests the results were satisfactory and the amount of insulation, and/or adhesion and/or flame inhibition could be easily adjusted by  
20. variations of the formulae.

5. Tests have been conducted with various combinations of the formula on Paper, Cardboard, wood, plywood, thatch, straw, fibreboard, Gypsum board, Xmastrees, bushes, brushwood, trees, military unifoms and tents.
10. Applications have been applied to cooking ovens, refrigerator walls and door, fireproof doors, aircraft cowlings, all with satisfactory results.

#### CLAIMS

15. Methods of formulating and applying aqueous and/or sodium silicate based solutions to provide fire protection, fire inhibiting, flame retarding, waterproofing, insulating, (and in the case of fuels, fire extinguishing and fireretarding) of
20. cellulose content and in particular cardboard, wood products, and similar flammable substrates both in the production line and in situ, also forestry, thatch, bushes, straw. etc which will render them both unable to support combustion and
25. also to provide insulation by reducing the conduction of heat and cold and which solutions can be either/or/and waterproof, non hazardous, bio-degradable, non-toxic, edible, not ozone, depleting environmentally acceptable, and smoke and
30. toxic fume depleting.

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5. Variations of the formulations provide th ability to extinguish fire and simultaneously render the area with a fire retardent protection.  
The formulations consisting of variations of the
10. ingredients listed heretofore.

**Amendments to the claims have been filed as follows**

1. A composition of matter comprising an aqueous solution including and/or excluding some of the components (a) to (w) as hereinbefore listed.
2. A composition as claimed in Claim 1 including and/or excluding some of the components (c), (d), (g), (l), (n), (q), (r), (s), (v) and (w) as hereinbefore listed.
3. A composition as claimed in Claim 1 including and/or excluding some of the components (d), (g), (k) and (w).
4. A composition as claimed in Claim 1 including and/or excluding some of the components (h), (i), (k) and (q).
5. A composition as claimed in Claim 1 which comprises tripotassium citrate and one or more additional components.
6. A composition as claimed in Claim 1 and substantially as hereinbefore described.
7. A method of providing fire proofing, fire resistance or fire retardation to an article which comprises applying a composition as claimed in any one of Claims 1 to 6 to that article, and removing any water and/or solvent.



# The Patent Office

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Application No: GB 9510552.4  
Claims searched: 1

Examiner: Peter Davey  
Date of search: 16 July 1996

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): D1P (PDH, PDX, PH, PWE, PWH)

Int Cl (Ed.6): B27K 3/16 3/20 3/32 3/52; D06M 11/56 11/71 11/79

Other:

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2276639 A (CSIR), see eg. claims 11, 13	1
X	WO 90/13699 A1 (NEDERLANDSE ORGANISATIE), see eg. claim 1	1
X	WO 88/00482 A1 (TOJ), see eg. claim 13	1
X	EP 0467855 A2 (HATAB), see eg. claim 3	1
X	US 5023019 (BUMPUS), see eg. claims 1, 7	1
X	US 4737406 (BUMPUS), see eg. claims 1-3	1
X	US 3974318 (LILLA), see eg. claims 1, 5	1
X	US 3935343 (US GYPSUM), see eg. Ex. 1	1

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

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A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.